a light detector arrangement including individual light detectors that correspond to individual ones of a plurality of transmitted light beams caused by the intersection of the plurality of light beams with the surface of the substrate and by passing the plurality of light beams through the substrate, the light detectors being arranged for sensing the light intensity of the transmitted light.

REMARKS

In the Office Action, the Examiner rejected claim 1-18, 20-22, 24-31 and 33-40 under 35 USC 103. These rejections are fully traversed below.

The Examiner also provisionally rejected claims 1-41 and 44-45 under the judicially created doctrine of obviousness type double patenting. The provisional rejection has been overcome with a terminal disclaimer enclosed herewith.

Claim 24 has been amended. Claim 47 has been added. Thus, claims 1-41, 44-45 and 47 are pending in the application. Reconsideration of the application is respectfully requested based on the following remarks.

ISSUES UNDER 35 USC 103(a)

Claims 1-18, 20-22, 24-31 and 33-40 have been rejected under 35 U.S.C. §103(a) as being unpatentable over *Sanada* et al (6,084,716) in view of *Shikichi* et al (5,151,888) or *Karaki* et al (5,130,965).

The present invention provides an improved optical inspection system for inspecting the surface of a substrate (e.g., finding defects), and more particularly to an optical inspection system that can scan a substrate at a high speed and with a high degree of sensitivity. The invention is particularly suitable for increasing inspection rates associated with reticles, photomasks and the like. Generally speaking, the optical inspection system includes components for generating a plurality of beams that are scanned on the substrate and components for collecting and detecting a plurality of beams that are reflected and/or transmitted from the substrate as a result of the scanned beams. As should be appreciated, by increasing the number of scanning beams, a wider scan can be produced thereby increasing the speed of inspection.

In looking at the present invention and the prior art, it appears that the Examiner constructed the claimed invention out of isolated teachings in the prior art. As should be appreciated, the mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. To elaborate, the rejected claims are generally directed at an optical inspection system (or method thereof) that includes a light source, a first set of optical elements for separating a light beam into a plurality of light beams, and individual light detectors that each receive individual ones of a plurality of transmitted and/or reflected light beams. With regards to the rejections, the Examiners primary reference (*Sanada*) does not disclose individual light detectors as required in the claims and thus the Examiner relied on a combination with *Shikichi* or *Karaki*, each of which appears to disclose a plurality of detectors. The combinations are believed to be improper, i.e., one of skill in the art would not have been motivated to combine these references in a manner that rendered the claimed invention obvious.

Initially, the Examiner asserted that the rational for the combination arose from the fact that all of the references are related to an inspection device. This is not the case, however, since *Karaki* and *Shikichi* are not directed at inspection devices at all, but rather recording and reproduction devices. The Examiner subsequently asserted that "the rationale for this modification would have been arisen from the fact that using individual detector for detecting individual beams of light would eliminate the interference between the signals if using a single detector, thus using different detectors would increase the signal to noise ratio. This rationale is no better than the first. First, none of these references (e.g., *Shikichi* or *Karaki*) teach problems with interference. In fact, the Examiner is respectfully requested to provide evidence of such a feature (especially if it is well known) in order to maintain the rejection. Second, neither *Karaki* or *Shikichi* teach, suggest or provide the incentive of using multiple detectors for the purpose of increasing the speed of inspection as in the present invention. Both references are completely silent to increasing the speed of detection by using multiple detectors and thus they fail to make a prima facie case of obviousness, i.e., without this distinction there is no desirability to combine. As should be appreciated, the Examiner must show reasons that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention would select the elements from the cited prior art references for combination in the manner claimed.

In the present invention, the multiple detectors are used to receive multiple light beams, each of which scans a different area of a substrate. The multiple light beams are formed by separating a single light beam into multiple light beams. The amount of light beams produced generally corresponds to the desired inspection speed, i.e., the greater the number of light beams, the greater the inspection speed. By way of example, a single beam may be separated into three beams. By triplicating the beam, a wider scan is produced and therefore the resulting inspection speed is about three times faster than the speed produced for a non-triplicated single beam (see Fig. 8).

As shown in Fig. 5, the scanning spot distribution 122 includes offset and staggered scanning spots 124A-C, each of which has a scanning length L that forms a scanning stripe 125A-C in the Y-direction. Correspondingly, the combination of each of the scanning stripes 125A-C forms an overall scanning swath, S. As shown in Fig. 8, the swath, S, is in a direction such that, after passing through the inspection optics, it is directed parallel to the Y-axis as viewed at the substrate 12. As the beams are swept, the stage carrying the substrate 12 under test is caused to move back and forth in the direction of the X-axis, for an inspection length I, while being incremented in the Y-direction at the end of each traverse so that the scanning spots 124A-C are caused to sweep along a serpentine path 153 across a predetermined area of the substrate 12. The predetermined area may correspond to a single identified sub area, a plurality of identified substrate sub areas (such as individual dice in the case of a photomask) or the entire substrate (see generally page 22, lines 4-16).

Karaki and *Shikichi* simply do not use multiple beams in this manner (e.g., to increase speed). For one, the light beams always follow tracks. For another, each of the light beams serves a different function and thus they are not additive as can be achieved with the present invention. Both references have a primary beam for recording and reproducing and sub beams for tracking or determining recording quality. The beams and thus the detectors of *Karaki* and *Shikichi* simply do not work together to increase the scanning rate.

In *Shikichi*, light spots S_1, S_2 and S_3 scan an optical card, and optical sensors 10_1, 10_2, 10_3, receive the light beams from the spots S_1, S_2 and S_3. On the recording layer of the optical card, there are preformed a plurality of parallel tracking tracks and a recording area provided between adjacent tracking tracks. Spots S_1 and S_3 follow the tracking tracks for the purposes of tracking, and spot S_2 follows the recording area for the purposes of reproducing.

Correspondingly, optical sensor 10_2 produces a reproduction signal and optical sensors 10_1 and 10_3 produce tracking signals. In fact, as shown in Fig. 2, the optical sensors are different since they serve different functions. The beams and thus the detectors simply do not work together to increase the scanning rate as is achievable with the present invention.

Karaki has similar deficiencies. Like *Shikichi*, *Karaki* discloses three beams B1, B2, B3. B1 irradiates a light spot S1 which causes the corresponding pit to be recorded or reproduced. B2 and B3 serve as sub beams for generating tracking error signals at the time or reproduction and recording error signals at the time of recording. B1 is always formed on the central portion of an information track. During reproducing B2 and B3 are displaced from the center of the information track. During recording, B2 and B3 are located at the center of the information track. Furthermore, like *Shikichi, Karaki* discloses different optical detectors for the different beams. As shown in Fig. 3 of *Karaki,* optical detector 11 includes receiving surface 11e for spot S2, receiving surface 11f for spot S3 and receiving surfaces 11a-11d for spot S1. The beams and thus the detectors simply do not work together to increase the scanning rate as in the present invention.

To emphasize the above, the detectors of *Karaki* and *Shikichi* are completely different than the detectors of the present invention. The detectors of the present invention are used to in conjunction with multiple beams to inspect a substrate. Each of the beams is configured to scan a different part of the substrate in order to increase the inspection rate. As such, each of the detectors are similar, i.e., they perform the same function but with a different light beam. In contrast, the detectors of *Karaki* and *Shikichi* are different. As shown in Fig. 3 of *Karaki* and Fig. 2 of *Shikichi,* the detectors are not the same. Each detector is for a different beam. For example, in *Karaki* beam S_2, which is used for recording and reproducing is made incident on sensor 10_2 for the purpose of producing a recording/reproducing signal and S_1 and S_3, which are used for tracking are made incident on sensors 10_1 and 10_3 for the purpose of producing tracking signals. In the present invention, all three beams and all three detectors are used for inspection. They serve the same functions, but in a different area of the substrate. The detectors of *Karaki* and *Shikichi* would simply not work to increase the inspection speed as in the present invention.

Even if there is a basis for combining the references, the references are not properly combinable if their intended function is destroyed. As should be appreciated, the CCPA and the Federal Circuit have consistently held that when a 103 rejection is based upon a modification of

a reference that destroys the intent, purpose or function of the invention disclosed in the reference, such a proposed modification is not proper and the prima facie case of obviousness can not be properly made. See for example, In re Gordon, 7333 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

With regards to claims 1 and 25, the combination of *Shikichi* to *Sanada* appears to destroy the function of the invention disclosed in *Shikichi* and the combination of *Karaki* to *Sanada* appears to destroy the function of the invention disclosed in *Karaki.* In particular, *Shikichi* would not function as intended by using transmitted light (that has passed through the substrate). *Shikichi* uses reflectance to detect tracks of information. If light was transmitted through the optical card then the intended function of detecting information via reflectance would be destroyed. To further this point, the optical card includes a recording layer having tracks, which contain recorded information that is optically detected via their reflectance. In order to use transmitted light, the recording layer would have to have transparent portions, which would adversely effect the tracking of tracks, the recording of pit rows, reproducing of pit rows and the like (see Col. 2, lines 33-43). *Karaki* has similar problems as *Shikichi. Karaki* is directed towards compact discs that include a reflective surface for reading information therefrom. If the reflective surface had transparent portions then the information on the compact disc would not be able to be read. For example, the tracking beams would not be able to follow the track and thus the recording and reproducing beam would be lost. Accordingly, the rejection is improper and should be withdrawn.

With regards to claim 22, the combination of *Shikich* to *Sanada* appears to destroy the function of the invention disclosed in *Shikichi.* In particular, *Shikichi* would not function as intended by sweeping a plurality of beams. In *Shikichi,* at least some of the beams are used for maintaining the position of the beams along a track as the optical card is moved (e.g. tracking). If the tracking beams were swept, then their intended function of maintaining a position along the track would be destroyed. *Karaki* has the same problems (e.g., tracking beams).

Moreover, it is believed that *Karaki* and *Shikichi* are nonanalogous art. As is well known, 35 USC 103 requires that obviousness be determined on the basis of whether at the time the invention was made a person of ordinary skill in the art to which the subject matter pertains would have found the claimed invention as whole obvious. Although one of ordinary skill in the art is presumed to be aware of all the prior art in the filed to which the invention pertains, he is

not presumed to be aware of prior art outside that field and the field of the problem to be solved, i.e., non analogous art. Analogous art, according to the CCPA and Federal Circuit cases, is all art that is either 1) in the field of technology of the claimed invention or 2) deals with the same problem solved by the claimed invention even though outside the field of technology of the invention. For example, the CCPA held in *In re Wood*, 599 F.2d 1032, 202 USPQ 171 (CCPA 1979): The determination that a reference is from nonanalogous art is therefore twofold. First, we decide if the reference is within the field of the inventor's endeavor. If it is not, we proceed to determine whether the reference is reasonably pertinent to the particular problem with which the inventor was involved.

With regards to the first part of the two prong inquiry, both *Karaki* and *Shikichi* are directed at optical recording and reproducing apparatus. In particular, *Karaki* is directed at recording and reproducing of compact discs, and *Shikichi* is directed at recording and reproducing optical cards. In contrast, the present invention is directed at a system for inspecting reticles, masks or semiconductor wafers. While the technologies may be based in optics, it should be appreciated that recording and reproducing compact discs is a much different field than finding defects in reticles, masks or semiconductor wafers. Neither of these references teaches or suggests inspection for the purpose of finding defects as in the present invention. With regards to the second part of the two prong inquiry, *Karaki* is directed at improving the quality of prior to recording and after recording monitoring signals without newly providing a complicated optical system, and *Shikichi* is directed at overcoming problems related to tracking, i.e., when the recording or reproducing beam deviates from the recording area. In contrast, embodiments of the present invention serve to improve the scanning speeds of an inspection system. Neither *Karaki* nor *Shikichi* suggest improving scanning speeds. Accordingly, the rejection is believed to be improper and thus the rejection should be withdrawn.

In summary, it seems that there are several layers of separation between the references that make it difficult to imagine a valid combination. For one, the references are not in the same field of endeavor. *Sanada* is directed at an inspection system and *Karaki* and *Shikichi* are directed at reproducing/recording devices. Further, *Sanada* is associated with reticles and masks for making semiconductor circuits while *Karaki* is associated with compact discs and *Shikichi* is associated with optical cards (e.g., computer readable medium). Further still, both *Karaki* and *Shikichi* do not teach or suggest multiple beams for increasing the scanning rate as in the present invention. Each of these references is trying to solve a completely different problem.

Even though the rejections are believed to be improper for the reasons given above, the claimed invention is still believed to be patentably distinguishable from the cited combinations. For example:

In contrast to *Sanada* and *Karaki or Shikichi*, claim 1 specifically requires, "a light detector arrangement including individual light detectors that each receive individual ones of the plurality of transmitted light beams," and claim 25 specifically requires, "...a light detector arrangement including individual light detectors that correspond to individual ones of a plurality of reflected and transmitted light beams..." While *Sanada* may disclose receiving transmitted light, *Sanada* does not teach or suggest a plurality of detectors, each of which receives a distinct transmitted light beam. *Sanada* only discloses using one detector (406). Furthermore, while *Karaki* or *Shikichi* may disclose a plurality of detectors, *Karaki* or *Shikichi* do not teach or suggest a plurality of detectors, each of which receives a distinct transmitted light beam. In *Karaki,* light is used to record and reproduce on or from a rotating compact disc, and in *Shikichi*, light is used to record and reproduce on or from an optical card. This is accomplished by receiving "reflected light beams" not transmitted light beams that have passed through the substrate. As stated in claim 1, "...a plurality of transmitted light beams caused ....by passing the plurality of light beams through the substrate."

To elaborate, *Karaki* is directed towards compact discs that include a reflective surface for reading information therefrom. If the reflective surface had transparent portions then the information on the compact disc would not be able to be read. For example, the tracking beams would not be able to follow the track and thus the recording and reproducing beam would be lost. Furthermore, *Shikichi* uses reflectance to detect tracks of information. If light was transmitted through the optical card then the intended function of detecting information via reflectance would be destroyed. To further this point, the optical card includes a recording layer having tracks, which contain recorded information that is optically detected via their reflectance. In order to use transmitted light, the recording layer would have to have transparent portions, which would adversely effect the tracking of tracks, the recording of pit rows, reproducing of pit rows and the like (see Col. 2, lines 33-43). Hence, neither reference teaches or suggests individual light detectors that receive transmitted light beams. Accordingly, the rejection is unsupported by the art and should be withdrawn.

Furthermore, it is believed that the rejections to claims 1 and 25 are improper because *Karaki* and *Shikichi* teach away from the claimed invention. The Supreme Court held in U.S. v. Adams, 383 U.S. 39, 148 USPQ 479 (1966), that one important indicium of nonobviousness is "teaching away" from the claimed invention by the prior art or by experts in the art at the time the invention was made. Teaching away is the antithesis of the art suggesting that the person of ordinary skill go in the claimed direction. In particular, *Karaki* and *Shikichi* only teach using reflected light. *Karaki* and *Shikichi* would not function if transmitted light were used in place of reflected light as required by claims 1 and 25. This is viewed by the Applicant as teaching away from transmitted light. In a similar vein, *Karaki* and *Shikichi* also teach away from claim 22, which requires, "sweeping the plurality of light beams..." In *Karaki* and *Shikichi,* the beams are not swept, but rather held in one position so as to follow a track that is moved. Accordingly, the rejections to these claims are improper and should be withdrawn.

DOUBLE PATENTING

Claims 1-41, 44 and 45 have been provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 1-20 of copending Application No. 09/636,129.

A terminal disclaimer has been filed herewith to overcome the provisional double patenting rejection.

ALLOWABLE SUBJECT MATTER

Claims 19, 23, 32, 41, 44 and 45 appear to be in a condition for allowance since the double patenting rejection has been overcome with the terminal disclaimer (these claims have not been rejected for any other reason). New claim 47 also appears to be in a condition for allowance for at least the same reasons, i.e., claim 47 includes the limitations of independent claim1 and allowed dependent claim 19.

SUMMARY

Applicant believes that all pending claims are allowable and respectfully requests a Notice of Allowance for this application from the Examiner. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at the telephone number set out below.

Respectfully submitted,
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APPENDIX

24. (Once Amended) An optical inspection system for inspecting the surface of a reticle **for defects**, comprising:

a light source for emitting an incident light beam along an optical axis;

a first set of optical elements arranged for separating the incident light beam into a plurality of light beams, directing the plurality of light beams to intersect with the surface of the reticle, focusing the plurality of light beams to a plurality of scanning spots on the surface of the reticle**, and sweeping the plurality of light beams so as to move the plurality of scanning spots along the surface of the reticle, the plurality of light beams working together to increase the speed of inspection**; and

a light detector arrangement including individual light detectors that correspond to individual ones of a plurality of reflected or transmitted light beams caused by the intersection of the plurality of light beams with the surface of the reticle, the light detectors being arranged for sensing the light intensity of either the reflected or transmitted light.